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Is science in danger of sanctifying the wolf?

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ABSTRACT

Historically the wolf (*Canis lupus*) was hated and extirpated from most of the contiguous United States. The federal Endangered Species Act fostered wolf protection and reintroduction which improved the species' image. Wolf populations reached biological recovery in the Northern Rocky Mountains and upper Midwest, and the animal has been delisted from the Endangered Species List in those areas. Numerous studies in National Parks suggest that wolves, through trophic cascades, have caused ecosystems to change in ways many people consider positive. Several studies have been conducted in Yellowstone National Park where wolf interactions with their prey, primarily elk (*Cervus elaphus*), are thought to have caused reduction of numbers or changes in movements and behavior. Some workers consider the latter changes to have led to a behaviorally-mediated trophic cascade. Either the elk reduction or the behavioral changes are hypothesized to have fostered growth in browse, primarily willows (*Salix* spp.) and aspen (*Populus* spp.), and that growth has resulted in increased beavers (*Castor Canadensis*), songbirds, and hydrologic changes. The wolf's image thus has gained an iconic cachet. However, later research challenges several earlier studies' findings such that earlier conclusions are now controversial, especially those related to causes of browse regrowth. In any case, any such cascading effects of wolves found in National Parks would have little relevance to most of the wolf range because of overriding anthropogenic influences there on wolves, prey, vegetation, and other parts of the food web. The wolf is neither a saint nor a sinner except to those who want to make it so.

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1. Introduction

"The only good wolf is a dead wolf." This and many similar slogans typified public attitudes toward wolves (*Canis lupus*) in the United States before the late 1960s. Leaders, too, agreed with this attitude. Teddy Roosevelt, for example called the wolf, "The beast of waste and desolation."

Even some of the pioneering environmentalists, naturalists, and wildlife biologists vilified wolves. Naturalist Ernest Thompson Seton poisoned them. William Hornaday stated "of all the wild creatures of North America, none are more despicable than wolves. There is no depth of meanness, treachery or cruelty to which they do not cheerfully descend." In the first comprehensive book about wolves, Young and Goldman (1944, p. 1), senior biologists of the US Fish and Wildlife Service on page 1 called the wolf "a menace to human life." Even Aldo Leopold, well-known for his conclusions that the removal of large carnivores fostered increased herbivores and overbrowsing, shot wolves and in 1946, long after he experienced the famous "fierce green fire," he recommended wolves be bountied to increase abundance of big game populations (Mech, 2002).

Now the tables have turned. The Satan wolf has become a saint in the minds of most of the general public. Ever since the wolf was placed on the federal Endangered Species List in 1967, it became one of the main symbols of endangered species, featured in posters, tee shirts, documentaries, and magazines. Numerous books have since been written about wolves. (I count over 30 on my bookshelf.) Some 27 non-governmental organizations have been formed to promote wolf preservation. Except for some local areas where wolves have recovered and anti-wolf sentiment is increasing again, wolves are now considered by the general public primarily in a positive light (Williams et al., 2002).

The legal protection that the Endangered Species Act of 1973 afforded the wolf, as well as the reintroduction of wolves into Yellowstone National Park and Idaho, allowed wolf populations to thrive in the Upper Midwest and Northern Rocky Mountains to the point where years ago they reached official biological recovery levels (USFWS, 2011a,b). Along with their recovery came numerous studies of wolf ecology and reported effects of wolves on ecosystems, not only in Yellowstone but in other parks as well, where wolves had also been recovering. Wolves have now been credited by both the scientific literature, and especially the popular media, with everything from increasing populations of beetles and birds to replenishing ground water (Table 1). These diverse reported effects of wolves are attributed to trophic cascades, which

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Table 1
Claims made by popular media and websites about ecological effects of wolves.

The basis for these claims in the scientific literature are discussed in the text.
Reducing prey numbers and changing their movements[a,b,c,d,e,f]
Regenerating aspen, willows[a,b,c,f,h,j,k]
Improving habitat for beavers, songbirds, fish, small mammals, moose, amphibians, insects and waterfowl[a,c–g,i,k]
Promoting streambank recovery[a,c,d,e,k]
Reducing coyote density[a,d,e,k]
Providing food for scavengers[a,c,k]
Selecting old, weak, sick prey and maintaining healthy herd[a]
Reducing disease transmission[a]
Increasing bison[d]
Increasing raptors[e,k]
Improving water quality[a]
Replenishing ground water[a]
Cooling water[a,c,e,k]
Increasing pronghorns[e]

[a] Jackson Hole Conservation Alliance (www.jhalliance.org/).
[b] Pickrell, 2003. Wolves' leftovers are Yellowstone's gain, study says. National Geographic News, December 4, 2003.
[c] Robbins, 2005. Hunting habits of wolves change ecological balance in Yellowstone. New York Times, October 18, 2005.
[d] Chadwick, 2010. Wolf wars. National Geographic Magazine, March, 2010.
[e] Living with wolves (www.livingwithwolves.org).
[f] Powell, 2011. Florida panthers and Yellowstone wolves in the backyard. BBC News, 7 March 2011.
[g] Bass, 2005. Wolf Palette. Orion Magazine, July/August 2005.
[h] Anonymous, 2007. Presence of wolves allows aspen recovery in Yellowstone, Science Daily, July 31, 2007.
[i] Holdon, 2009. Wolves to the rescue in Scotland. Science Now, July 2009.
[j] Smith, 2010. Destination Science: Yellowstone National Park, USA Discover Magazine, April 2010.
[k] Robbins, 2004. Lessons from the wolf. Scientific American 29(6):84–91.

have long been postulated for various systems (Hairston et al., 1960; Carpenter et al., 1985; Estes et al., 2011) resulting from either large carnivore reduction of prey numbers (direct effects) or from causing prey to change their movements and/or behavior (indirect effects). These changes are then hypothesized to reduce or better scatter the prey's effects on vegetation such as willow (*Salix* spp.) and aspen (*Populus* spp.). Increased willow and aspen growth in turn fosters other species such as songbirds and beavers (*Castor canadensis*) that rely on the vegetation. Those species, especially beavers, are then said to cause another cascade of effects on waterways, leading to such effects as raising the water table and the consequent effects of that (Table 1). That trophic cascades exist is well documented (Beschta and Ripple, 2009; Terborgh and Estes, 2010). Whether recently restored wolves have already wrought the cascading effects attributed to them is the question here.

As was the case with the historical anti-wolf reports of devastating effects on prey, the new reports of wolf benefits by both lay people and scientists also may be exaggerated compared to the scientific evidence. As one reviewer of this article put it, "ecologists (and particularly conservation biologists) do seem obsessed to the point of blindness with predator-induced trophic cascades." This article examines some key reported wolf benefits, mostly based on studies in Northern Yellowstone because that area has been a strong focus of recent research. It attempts to place these findings in the perspective of what we really know about the ecosystem impacts of wolves. True, some of the more extreme claims are found more in the popular media, but most of them have at least some basis in scientific articles summarized by Hebblewhite and Smith (2010) and Eisenberg (2010). With wolf recovery has come an increased polarization between those laypeople who revere the animal and those who revile it. Establishing a more-accurate public and scientific image of the wolf is important so that authorities can better manage the species and promote accurate public understanding about the rationale for various kinds of wolf management.

It is not that scientists failed early on to warn about overstating or overgeneralizing wolf effects on ecosystems. After reviewing several such reported effects, Mech and Boitani (2003, p. 160) concluded "we do not claim to know whether the wolf's effects are positive or negative, what its net effect is, or whether the effects are of any great consequence ecologically." Smith et al. (2003, p. 339) warned that "the danger we perceive is that all changes to the [Yellowstone] system, now and in the future, will be attributed solely to the restoration of the wolf." Similarly Garrott et al. (2005) cautioned about generalizing wolf effects, and Ray et al. (2005, p. 426) warned that "... scientists will likely never be able to reliably predict cascading impacts on elements of biodiversity other than prey."

Hebblewhite and Smith (2010) explored the various complexities of trying to determine possible cascading effects of wolves on ecosystems. They concluded that across three systems, Banff, Isle Royale, and Yellowstone National Parks, trophic effects of wolves were quite variable and depended on time since wolf recolonization, ecological complexity of the community, and unknown factors that regulated the top-down strength of predation (Melis et al., 2009; Vucetich et al., 2011). Unfortunately the review by Hebblewhite and Smith (2010) was completed before some of the more recent findings discussed below were available.

2. Reports about wolf effects

The reports about wolf effects on the ecosystem fall into three main categories: (1) direct effects on coyotes (*Canis latrans*), (2) benefits to scavengers, and (3) cascading effects of wolf interactions with prey to other species in the wolf food chain.

2.1. Reduction of coyotes

Much has been made of the initial report that reintroduced wolves have reduced coyote numbers in Yellowstone National Park (Crabtree and Sheldon, 1999), a finding in accord with earlier work (Mech, 1966), and several other studies confirm that wolves kill coyotes and tend to reduce their numbers (summarized by Ballard et al. (2003)). What has grabbed the imagination of researchers and the public about a reduction in coyotes in Yellowstone is the